PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number: WO 92/22205
A01N 53/00, 65/00	A1	(43) International Publication Date: 23 December 1992 (23.12.92)

(21) International Application Number: PCT/AU92/00270

(22) International Filing Date: 9 June 1992 (09.06.92)

(30) Priority data:
PK 6689 14 June 1991 (14.06.91) AU

(71) Applicant *(for all designated States except US)*: PELLET TECHNOLOGY AUSTRALIA PTY. LIMITED [AU/AU]; 7 Terry Road, Dulwich Hill, NSW 2203 (AU).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : ROWLAND, Thomas, John [AU/AU]; 15 Waterside Parade, Peakhurst, NSW 2210 (AU).

(74) Agent: F.B. RICE & CO.; 28A Montague Street, Balmain, NSW 2041 (AU).

(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC (European patent), MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, RU, SD, SE, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.
With amended claims.

(54) Title: SLUG AND SNAIL REPELLING AND/OR KILLING COMPOSITION

(57) Abstract

A composition for repelling and/or killing snails and slugs comprising an effective amount of a pyrethrin or a mixture of pyrethrins and a carrier. The pyrethrin is preferably in the form of the mark remaining after the solvent extraction of pyrethrins from the flowers of the pyrethrin containing plants. The carrier preferably comprises bran, or another food attractant for snails and slugs and ground rice hulls.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FI	Finland	ML	Mali
AU	Australia	FR	France	MN	Mongolia
BB	Barbados	GA	Gabon	MR	Mauritania
BE	Belgium	GB	United Kingdom	MW	Malawi
BF	Burkina Faso	GN	Guinea	NL	Netherlands
BG	Bulgaria	GR	Greece	NO	Norway
BJ	Benin	HU	Hungary	PL	Poland
BR	Brazil	IE	Ireland	RO	Romania
CA	Canada	IT	Italy	RU	Russian Federation
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland			SN	Senegal
CI	Côte d'Ivoire	KR	Republic of Korea	SU	Soviet Union
CM	Cameroon	LI	Liechtenstein	TD	Chad
CS	Czechoslovakia	LK	Sri Lanka	TG	Togo
DE	Germany	LU	Luxembourg	US	United States of America
DK	Denmark	MC	Monaco		
ES	Spain	MG	Madagascar		

Slug and Snail Repelling and/or Killing Composition

Field of the Invention

The present invention relates to a slug and snail repelling and/or killing composition and more particularly to such a composition which may be produced from materials which would otherwise considered to be waste materials.

Background of the Invention

Slugs and snails are a considerable pest to domestic gardeners and commercial plant growers. It is known to produce snail and slug killing compositions which are attractive to the animals and which poison them when eaten. Such slug and snail killers typically comprise a food material for the animal together with a molluscicidal composition which poisons the slugs and snails. The present inventor has realized that an effective slug and snail repelling and/or killing composition may be produced from materials typically considered not to have molluscicidal properties and which in preferred embodiments of the invention, are obtainable from waste residues of other processing operations.

Disclosure of the Invention

The present invention consists in a slug and snail repelling and/or killing composition containing an effective amount of a pyrethrin or a mixture pyrethrins and a carrier therefor.

The pyrethrins are a family of naturally occurring insecticidal compositions found in the flowers of pyrethrum daisies such as Pyrethrum cinerariaefolium. In the recovery of the pyrethrum compounds the daisies are harvested, dried, ground and, normally, pelletized. The dried and pelleted material is then typically subjected to solvent extraction. The present inventor has found that the marc resulting from this solvent extraction process can be used very effectively in the production of compositions which repel and/or kill slugs and snails.

The present invention is not limited to the use of pyrethrins contained in the marc. Natural or synthetic pyrethrins in purified or semi-purified form may be added to a suitable carrier to produce a slug and snail repelling and/or killing compositions according to the present invention. The use of the pyrethrin marc is preferred as it is a waste material typically having a low value.

The composition according to the invention preferably contains less than 0.1% by weight and preferably less than 0.01% by weight of pyrethrin. The pyrethrin could be present as a single compound but would be more likely to be a mixture of two or more of the individual compounds making up the pyrethrin family.

The marc is preferably mixed with a solid carrier which may be pelletized. This carrier preferably comprises a substantial proportion of waste materials such as ground rice hulls or straw. If the material is to be pelletized then it is desirable to include compositions which are known to facilitate pelletizing. A suitable material is rice bran which includes oils which accelerate pelleting speeds and bentonite which acts as a binder for the formed pellets. The bran also comprises a food attractant for molluscs and the composition preferably includes such an attractant. Other suitable attractants include flour and starch. Other binders which could be used in the pelleting process include naturally occurring ligno sulphonates.

If desired the super fine material resulting from the pelleting process may be used to form a dusting powder useful for the repelling and/or killing of slugs and snails.

It has been found that the composition according to the present invention is repellant to dogs and cats. This is an important advantage in slug and snail repelling and

killing compositions as the conventional slug and snail killers are attractive to dogs and are also poisonous to them.

In a preferred embodiment the present invention comprises 10% of marc resulting from the solvent extraction of pelletized pyrethrum daisy meal and 90% of a carrier mixture. The marc contains less than half a percent of residual pyrethrins and is in material generally considered to be waste following the solvent extraction of the pyrethrins. The carrier mix preferably comprises 20% rice bran, 2% bentonite and 78% ground rice hulls, all of the foregoing percentages being percentages by weight. It has been found that when the above material is pelletized and the pellets sprinkled on a garden the garden is devoid of slugs and snails within a few hours of the application of the pellets. It was also found that plants in areas where the pellets had been spread did not show fresh slug and snail damage for a period of at least a few days after application of the pellets. It is not clear as to whether the slugs and snails are merely repelled by the composition according to this invention or whether they are actually killed by it. The inventor has noted that in an open garden situation snails in the area in which the composition according to the invention has been spread desist from eating plants and excrete large quantities of mucus. These molluscs tend to disappear quickly though it is not clear that they have died.

Best Mode for Carrying out the Invention

A composition according to the present invention by mixing together:-

(a) 10% by weight of a pyrethrin marc which was relatively finely ground but of a fibrous nature; this marc contained between 0.05 and 0.02% by weight of pyrethrins, and

(b) 90% by weight of a carrier material comprising

(i) 78.5% by weight finely ground rice hills,

(ii) 1.5% bentonite, and

(iii) 20% by weight finely ground bran.

The composition was passed through a pellet mill to produce a pale brown coherent pellet. This material is hereinafter referred to as "Sluggo".

2. INTRODUCTION

One replicated small plot trial was conducted during September and october 1991 to evaluate SLUGGO for the control of snails in lettuce seedlings. The trial was conducted at the Agrisearch Services Pty Ltd office and laboratory at Orange, New South Wales, Australia.

This report contains the experimental methods used and presents the results obtained.

3. EXPERIMENTAL DETAILS

3.1 Trial Site Location

The trial was conducted at the Agrisearch Services Pty Ltd office and laboratory in Orange, New South Wales. An area 9 metres by 4 metres behind the laboratory was rotary hoed and prepared for the lettuce seedlings.

3.2 Target Pest

The target pest was the common garden snail Helix aspersa. The snails were collected from gardens in the city of Orange, New South Wales one day prior to use. Medium to large snails were used.

3.3 Test Plants

Lettuce seedlings, variety Imperial, were used. The seedlings had four to six leaves when planted out. All plots were watered lightly each morning during the trial period.

3.4 Treatment List

Formulation	Rate Pellets/m^2	Rate Pellets/Plot*
1. SLUGGO	25	13
2. SLUGGO	50	25
3. BAYSOL SNAIL & SLUG KILLER	100	50
4. Untreated Control	-	0

* Only half of the 1 m^2 plots were treated. The treatments were applied once at commencement of the trial.

3.5 Formulation

SLUGGO - contains pyrethrin 25 mg/kg as the active ingredient in a bran based pellet with no colour. The formulation was as supplied by Pellet Technology Australia Pty Limited.

3.6 Trial Design

The trial was set up as a split plot design with the treatments as the main plots and "rainfall" as the sub-plots. "Rainfall" consisted of putting the treatments out on half the plots and watering them for two hours with a soaker hose. The total water applied was 35mm. The remaining plots were treated two hours after the "rainfall". Each sub-plot was 1 m^2 in area and contained six evenly spaced lettuce seedlings and two 17cm diameter plastic squat pots (one on the treated half and one on the untreated half of the sub-plot). The total number of sub-plots was twenty four; four treatments by two moisture regimes by three replicates. the plot and sub-plot layout is described below.

Plot layout

1 m

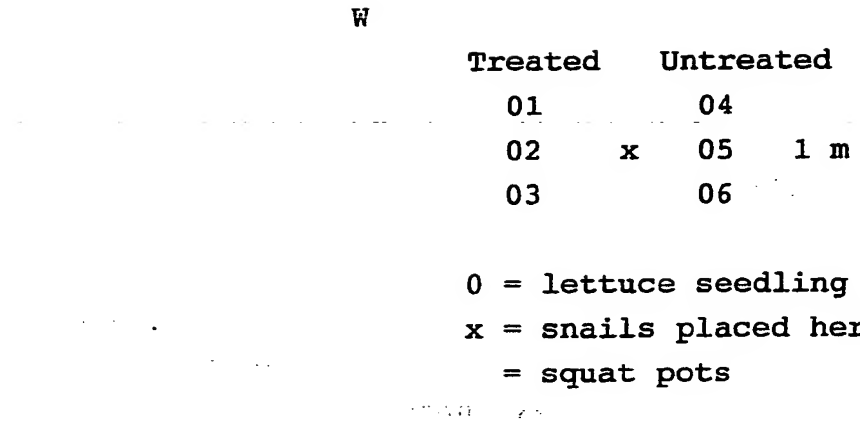
W

1 m			
	1*	3	2*
	1	3*	2
	4	2*	3
	4*	2	3*
	3*	4	1*
	3	4*	1
	1	2*	4
	1*	2	4*

* Simulated rainfall applied to pellets

Treatments numbered 1-4

Sub-plot Layout



Each of the sub-plots was enclosed with a black nylon shade cloth covered timber framed cage to prevent the snails from escaping.

3.7 Treatment Method

The treatments were applied evenly over half of each sub-plot around lettuce seedlings 1, 2 and 3. Seedlings 4, 5 and 6 were always on the untreated half of each plot.

3.8 Challenges and Assessments

All plots were challenged with fresh snails immediately after all treatments were applied and again at 6 and 13 days after treatment (DAT).

Assessment of snail activity was made at 1 and 3 days after each challenge, ie. 1, 3, 7, 9, 14, and 16 DAT. Snails were assessed as active, knocked down, or dead.

The position of the snails was recorded as; on the harbourage, on the lettuce seedlings, on the cage, or on the ground. Whether they were on the treated half or the untreated half of the sub-plots was also recorded.

Individual lettuce seedling damage was rated using a 0-10 scale based on percentage leaf eaten (10 = completely eaten). If seedlings were completely eaten then they were replaced for the next challenge. Seedlings were not replaced during a challenge.

Any phytotoxicity was recorded.

3.9 Statistical Analysis

From the number of snails active, knocked down, and dead data the percentage snails knocked down and dead was calculated. Analysis was only done to see if there was a difference in the efficacy of BAYSOL when "rainfall" was applied. To do this the data was transformed using SQRT(X+0.5) and analysed using a factorial analysis. Least significant differences (LSD) were calculated at the 5% level of probability to compare the means.

Lettuce plant damage data was transformed using SQRT(X+2) and analysed using a factorial analysis and LSD values calculated to compare means.

4. RESULTS AND DISCUSSION

The results are summarised in Tables 1-18. The results in full are presented in the Appendices. Means with common letters adjacent to them do not differ at the 5% level of probability. Data was transformed prior to analysis. See the Appendices for details.

Table 1 Summary of Results - Mean Percentage Snails Knocked Down and Dead at 1 Day After 1st Challenge

Formulation	Rate Pellets/m^2	Rainfall No	Rainfall Yes	Treatment Mean
1. SLUGGO	25	0.0	0.0	0.0 b
2. SLUGGO	50	0.0	0.0	0.0 b
3. BAYSOL	100	50.0	72.2	61.1 a
4. Untreated Control	-	0.0	0.0	0.0 b
Mean		12.5 a	18.1a	

Table 2 Summary of Results - Mean Percentage Snails Knocked Down and Dead at 3 Days After 1st Challenge

Formulation	Rate Pellets/m^2	Rainfall No	Rainfall Yes	Treatment Mean
1. SLUGGO	25	0.0	0.0	0.0 b
2. SLUGGO	50	0.0	0.0	0.0 b
3. BAYSOL	100	88.9	88.9	88.9 a
4. Untreated Control	-	0.0	0.0	0.0 b
Mean		23.6 a	25.0 a	

Table 3 Summary of Results - Mean Percentage Snails Knocked Down and Dead at 1 Day After 2nd Challenge

Formulation	Rate Pellets/m^2	Rainfall No	Rainfall Yes	Treatment Mean
1. SLUGGO	25	0.0	0.0	0.0 b
2. SLUGGO	50	0.0	0.0	0.0 b
3. BAYSOL	100	94.4	100.0	97.2 a
4. Untreated Control	-	0.0	0.0	0.0 b
Mean		22.2 a	22.2 a	

Table 4 Summary of Results - Mean Percentage Snails Knocked Down and Dead at 3 Days After 2nd Challenge

Formulation	Rate Pellets/m^2	Rainfall No	Rainfall Yes	Treatment Mean
1. SLUGGO	25	0.0	0.0	0.0 b
2. SLUGGO	50	0.0	0.0	0.0 b
3. BAYSOL	100	94.4	100.0	97.2 a
4. Untreated Control	-	0.0	0.0	0.0 b
Mean		23.6 a	25.0 a	

Table 5 Summary of Results - Mean Percentage Snails Knocked Down and Dead at 1 Day After 3rd Challenge

Formulation	Rate Pellets/m^2	Rainfall No	Rainfall Yes	Treatment Mean
1. SLUGGO	25	0.0	0.0	0.0 b
2. SLUGGO	50	0.0	0.0	0.0 b
3. BAYSOL	100	27.8	27.8	27.8 a
4. Untreated Control	-	0.0	0.0	0.0 b
Mean		7.0 a	7.0 a	

Table 6 Summary of Results - Mean Percentage Snails Knocked Down and Dead at 3 Days After 3rd Challenge

Formulation	Rate Pellets/m^2	Rainfall No	Rainfall Yes	Treatment Mean
1. SLUGGO	25	0.0	0.0	0.0 b
2. SLUGGO	50	0.0	0.0	0.0 b
3. BAYSOL	100	94.4	100.0	97.2 a
4. Untreated Control	-	0.0	0.0	0.0 b
Mean		23.6 a	25.0 a	

Table 7 Summary of Results - Mean Lettuce Plant Damage Rating** 1 Day After 1st Challenge

Formulation	Rate Pellets/m^2	Rainfall						Treatment Mean
		No			Yes			
		Treated	Untreated	Mean	Treated	Untreated	Mean	
1. SLUGGO	25	0.06	0.00	0.03	0.11	0.00	0.06	0.05 a
2. SLUGGO	50	0.0	0.0	0.00	0.01	1.34	0.68	0.33 ab
3. BAYSOL	100	0.00	0.00	0.00	0.00	0.01	0.01	0.01 a
4. Untreated Control	-	1.22	1.11	1.17	0.11	0.89	0.50	0.85 b
Mean				0.30 a			0.31 a	

** Rating - 0 = no damage, 10 = totally eaten

Table 8 Summary of Results - Mean Lettuce Plant Damage Rating** 3 Days After 1st Challenge

Formulation	Rate Pellets/m^2	Rainfall						Treatment Mean
		No			Yes			
		Treated	Untreated	Mean	Treated	Untreated	Mean	
1. SLUGGO	25	0.69	0.47	0.58	0.11	0.01	0.06	0.33 a
2. SLUGGO	50	0.17	1.39	0.78	0.29	1.46	0.87	0.83 a
3. BAYSOL	100	0.00	2.44	1.22	0.12	1.13	0.63	0.93 a
4. Untreated Control	-	1.69	4.61	3.15	8.56	3.44	6.00	4.58 b
Mean				1.43 a			1.89 a	

** Rating - 0 = no damage, 10 = totally eaten

Table 9 Summary of Results - Mean Lettuce Plant Damage Rating** 1 Day After 2nd Challenge

Formulation	Rate Pellets/m^2	Rainfall						Treatment Mean
		No			Yes			
		Treated	Untreated	Mean	Treated	Untreated	Mean	
1. SLUGGO	25	0.00	0.11	0.06	1.11	0.11	0.61	0.33 a
2. SLUGGO	50	0.11	0.06	0.08	0.11	0.11	0.11	0.12 a
3. BAYSOL	100	0.06	0.00	0.03	0.06	0.00	0.03	0.03 a
4. Untreated Control	-	1.22	0.28	0.75	3.17	1.61	2.39	1.58 b
Mean				0.23 a			0.79 a	

** Rating - 0 = no damage, 10 = totally eaten

Table 10 Summary of Results - Mean Lettuce Plant Damage Rating** 3 Days After 2nd Challenge

Formulation	Rate Pellets/m^2	Rainfall						Treatment Mean
		No			Yes			
		Treated	Untreated	Mean	Treated	Untreated	Mean	
1. SLUGGO	25	2.78	0.94	1.86	2.33	2.00	2.17	2.03 c
2. SLUGGO	50	0.22	1.33	0.78	0.44	1.28	0.86	0.82 b
3. BAYSOL	100	0.06	0.00	0.03	0.06	0.00	0.03	0.03 a
4. Untreated Control	-	3.33	8.22	5.78	7.78	5.67	6.72	6.25 d
Mean				2.11 a			2.45 a	

** Rating - 0 = no damage, 10 = totally eaten

Table 11 Summary of Results - Mean Lettuce Plant Damage Rating** 1 Day After 3rd Challenge

Formulation	Rate Pellets/m^2	Rainfall						Treatment Mean
		No			Yes			
		Treated	Untreated	Mean	Treated	Untreated	Mean	
1. SLUGGO	25	0.11	0.00	0.06	0.83	0.00	0.42	0.25 a
2. SLUGGO	50	0.00	0.00	0.00	0.00	1.44	0.72	0.37 a
3. BAYSOL	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00 a
4. Untreated Control	-	0.39	0.00	0.19	0.11	0.00	0.06	0.13 a
Mean				0.06 a			0.30 a	

** Rating - 0 = no damage, 10 = totally eaten

Table 12 Summary of Results - Mean Lettuce Plant Damage Rating** 3 Days After 3rd Challenge

Formulation	Rate Pellets/m^2	Rainfall						Treatment Mean
		No			Yes			
		Treated	Untreated	Mean	Treated	Untreated	Mean	
1. SLUGGO	25	0.06	0.22	0.14	2.22	0.33	1.28	0.70 ab
2. SLUGGO	50	1.33	0.06	0.69	0.39	2.44	1.42	1.07 b
3. BAYSOL	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00 a
4. Untreated Control	-	3.56	2.67	3.11	3.22	0.11	1.67	2.38 c
Mean				0.99 a			1.09 a	

** Rating - 0 = no damage, 10 = totally eaten

Table 13

Summary of Results

Total Number of Snails at Each Position When Assessed 1 Day After 1st Challenge

Formulation	Rate	Harbour		Cage		Ground	
	Pellets/m^2	Treated	Untreated	Treated	Untreated	Treated	Untreated
1. SLUGGO	25	16	10	8	1	0	1
2. SLUGGO	50	14	8	2	10	1	1
3. BAYSOL	100	3	2	0	7	22	2
4. Untreated Control	-	10	9	8	4	2	3

Table 14

Summary of Results

Total Number of Snails at Each Position When Assessed 3 Days After 1st Challenge

Formulation	Rate	Harbour		Cage		Ground	
	Pellets/m^2	Treated	Untreated	Treated	Untreated	Treated	Untreated
1. SLUGGO	25	21	9	5	1	0	1
2. SLUGGO	50	20	13	1	1	0	1
3. BAYSOL	100	0	1	0	0	33	2
4. Untreated Control	-	10	22	3	1	0	0

Table 15

Summary of Results

Total Number of Snails at Each Position When Assessed 1 Day After 2nd Challenge

Formulation	Rate	Harbour		Cage		Ground	
	Pellets/m^2	Treated	Untreated	Treated	Untreated	Treated	Untreated
1. SLUGGO	25	20	6	9	1	0	0
2. SLUGGO	50	20	8	4	4	0	0
3. BAYSOL	100	1	0	1	0	32	2
4. Untreated Control	-	13	8	10	4	1	0

Table 16

Summary of Results

Total Number of Snails at Each Position When Assessed 3 Days After 2nd Challenge

Formulation	Rate	Harbour		Cage		Ground	
	Pellets/m^2	Treated	Untreated	Treated	Untreated	Treated	Untreated
1. SLUGGO	25	22	13	1	0	0	0
2. SLUGGO	50	20	16	17	2	0	0
3. BAYSOL	100	0	0	0	1	35	0
4. Untreated Control	-	21	12	1	1	0	1

Table 17

Summary of Results

Total Number of Snails at Each Position When Assessed 1 Day After 3rd Challenge

Formulation	Rate Pellets/m^2	Harbour		Cage		Ground	
		Treated	Untreated	Treated	Untreated	Treated	Untreated
1. SLUGGO	25	26	4	3	1	1	1
2. SLUGGO	50	18	16	1	0	0	1
3. BAYSOL	100	12	6	6	0	11	1
4. Untreated Control	-	18	7	10	0	1	0

Table 18

Summary of Results

Total Number of Snails at Each Position When Assessed 3 Days After 3rd Challenge

Formulation	Rate Pellets/m^2	Harbour		Cage		Ground	
		Treated	Untreated	Treated	Untreated	Treated	Untreated
1. SLUGGO	25	23	11	0	0	0	2
2. SLUGGO	50	22	12	1	0	1	0
3. BAYSOL	100	0	2	0	0	28	6
4. Untreated Control	-	22	9	3	1	1	0

4.1 Lettuce Plant Damage

Although the SLUGGO pellets did not knockdown or kill the snails, the damage sustained by the lettuce seedlings in SLUGGO treated plots was statistically similar to that of seedlings in the BAYSOL treated plots, except at the 3 day assessment of the 2nd challenge. At that stage (six feeding days) a clear rate effect was observed with lettuce plant damage significantly higher in the plots treated with the low rate of SLUGGO. Significantly less lettuce plant damage occurred in the plots treated with BAYSOL compared with the plots treated with the high rate of SLUGGO. Damage was minimal to plants in the treated half of the high rate plots of SLUGGO compared to the damage to plants on the untreated half. That trend was evident at each assessment in the high rate of SLUGGO and to a lesser extent in the BAYSOL treated plots.

After six days of snail feeding on the SLUGGO pellets, no complete pellets remained in the plots. In plots treated at the low rate of SLUGGO there was the odd sign of bran flakes visible with flakes more prevalent in the plots treated at the higher rate. At all but two assessments, lettuce seedlings in the SLUGGO and BAYSOL treated plots had significantly less plant damage than the seedlings in the untreated plots. At the 1 day assessment of the 1st challenge, lettuce seedlings in the SLUGGO treated plots at the high rate of 50 pellets/m^2 had a similar mean lettuce plant damage rating to the untreated plots. This was due to one plant on the untreated half of one plot being almost totally consumed. The second time was at the 1 day assessment of the 3rd challenge when a cold night reduced snail feeding activity and low damage occurred in the untreated plots, hence similar damage to lettuce seedlings occurred in all treatment groups.

The simulated rainfall after application of the pellets to half the plots had no effect on lettuce plant

damage except at the 1 day assessment of the 2nd challenge. At that assessment there was significantly greater lettuce plant damage in the plots that received the "rainfall".

4.4 Snail Position Within Plots

In the SLUGGO treated plots snails were mainly found in the plastic squat pot harbourages. The majority of snails were on the harbourage in the treated half (southern side) of each plot. This may have been due to the snails appetite for the pellets and therefore they remained close to the pellets. The treated side was always the closest to the building nd so this may have influenced their aestivation habits.

Snails in the BAYSOL treated plots were found mainly on the ground as they were knocked down or dead. The majority were on the treated half (southern side) of the plots around the pellets.

The snails in the untreated plots were found mainly in the harbourages with some on the cage. Although no treatment was applied to the untreated plots, snails generally preferred the southern side of the plot. As previously mentioned, the proximity of the building may have had some effect.

4.3 Snail Control

SLUGGO snail pellets did not knockdown or kill any snails during the three snail challenges. At the 3 day assessment of the 1st challenge it was noted that snail excreta in the SLUGGO plots was pellet coloured (observed in the harbourages on both treated and untreated halves of the plot). Snails were consuming pellets and remaining active.

At the final assessment, 3 days after the 3rd challenge, none of the SLUGGO treated plots had pellets or broken down pellets visible but all BAYSOL treated plots had pellets visible. The BAYSOL treatment have good

control of the snails with 97% knocked down or dead at the 3 day assessment of each of the three challenges. The lower percentage of snails knocked down and dead at the 1 day after the 3rd challenge assessment could have been due to the low overnight temperatures decreasing snail feeding activity.

"Rainfall" on the BAYSOL pellets immediately after application did not significantly effect the activity given against snails during the trial period.

5. CONCLUSIONS

5.1 Lettuce seedling damage was similar in the SLUGGO and BAYSOL treated plots with significantly greater damage in untreated control plots. The SLUGGO pellets were more desirable to snails than the lettuce seedlings. Seedling damage increased in the plots treated with the low rate of SLUGGO at the 3 day assessment of the 2nd challenge. The increased seedling damage may have been due to the low level of the alternative food source (SLUGGO).

5.2 Lettuce seedlings within the treated half of the high rate of SLUGGO treatment had the least amount of damage of all the plots in both SLUGGO treatment groups.

5.3 The SLUGGO pellets were consumed by the snails as indicated by snail excreta which was pellet coloured (light brown).

5.4 Snails in the SLUGGO treated plots tended to harbour on the plastic squat pots in each plot with the treated side (southern half) being favoured. Snails in the BAYSOL treated plots were found mainly on the ground as they were knocked down or dead. In the untreated plots snails were also in the squat pot harbourages provided and generally on the southern half of the plot (the half closest to the building).

5.5 There was no sign of SLUGGO pellets at the final assessment and every BAYSOL treated plot had pellets visible.

5.6 SLUGGO snail pellets had no knock down activity against snails after three days exposure to pellets on three occasions; 0, 6, and 13 DAT. Fresh snails were used each time.

5.7 Good control of snails was given by BAYSOL at each challenge with 87% of snails either knocked down or dead at the three day assessment.

5.8 The simulated rainfall had little effect on the amount of seedling damage in the SLUGGO and BAYSOL treated plots and no effect on snail control.

5.9 No rainfall was recorded during the trial period and low overnight temperatures decreased the feeding activity of the snails during the 3rd challenge.

CLAIMS:

1. A slug and snail repelling and/or killing composition containing an effective amount of a pyrethrin or a mixture of pyrethrins and a carrier therefor.

2. A composition as claimed in claim 1 in which the composition contains less than 0.1% by weight of a pyrethrin or a mixture of pyrethrin.

3. A composition as claimed in claim 2 in which the composition contains less than 0.01% by weight of a pyrethrin or a mixture of pyrethrins.

4. A composition as claimed in claim 1 in which the pyrethrins are present in the composition as part of a marc resulting from the solvent extraction of pyrethrin from the flowers of pyrethrum daisies.

5. A composition as claimed in claim 4 in which the marc contains from 0.02 or 0.05% by weight of a pyrethrin or a mixture of pyrethrins.

6. A composition as claimed in claim 1 in which the carrier contains a food attractant for slugs and snails.

7. A composition as claimed in claim 6 in which the food attractant is selected from the group comprising bran, flour and starch.

8. A composition as claimed in claim 1 in which the carrier contains ground rice hulls.

9. A composition as claimed in claim 1 in which the composition comprises 10% by weight of pyrethrin marc containing from 0.02 ro 0.05% by weight of a pyrethrin of a mixture of pyrethrins, and 90% by weight of a carrier, the carrier comprising 78.5% by weight of finely ground rice hulls, 1.5% by weight bentonite and 20% by weight of rice bran.

AMENDED CLAIMS

[received by the International Bureau on 15 October 1992 (15.10.92); original claims 1-9 replaced by amended claims 1-7 (1 page)]

1. A solid slug and snail repelling and/or killing composition containing

a) a food attractant for slugs and snails; and

b) less than 0.1% by weight of the composition of a pyrethrin or a mixture of pyrethrins.

2. A composition as claimed in claim 1 in which the composition contains less than 0.01% by weight of a pyrethrin or a mixture of pyrethrins.

3. A composition as claimed in claim 1 in which the pyrethrins are present in the composition as part of a marc resulting from the solvent extraction of pyrethrin from the flowers of pyrethrum daisies.

4. A composition as claimed in claim 3 in which the marc contains from 0.02 or 0.05% by weight of a pyrethrin or a mixture of pyrethrins.

5. A composition as claimed in claim 1 in which the food attractant is selected from the group comprising bran, flour and starch.

6. A composition as claimed in claim 1 in which the carrier contains ground rice hulls.

7. A composition as claimed in claim 1 in which the composition comprises 10% by weight of pyrethrin marc containing from 0.02 to 0.05% by weight of a pyrethrin or a mixture of pyrethrins, and 90% by weight of a carrier, the carrier comprising 78.5% by weight of finely ground rice hulls, 1.5% by weight bentonite and 20% by weight of rice bran.

INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent classification (IPC) or to both National Classification and IPC

Int. Cl.[5] A01N 53/00, 65/00

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	WPAT, CAS 82: Keywords: slug, snail, mollusc, pyrethrin, chrysanthemum
Chem. Abstr	

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

AU : A01N 53/00, 65/00

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category*	Citation of Document, [11] with indication, where appropriate of the relevant passages [12]	Relevant to Claim No [13]
X	Chemosphere, Vol. 15, No. 4 pp. 493-498 (1986) SINGH D.K. et al "Piperonyl butoxide synergism with two synthetic pyrethroids against lymnaea acuminata". - whole document	1-9
X	The Science of the Total Environment, 67 (1987) pp. 263-267 SINGH D.K. et al "Effect of the synthetic pyrethroid permethrin on the snail lymnaea acuminata". whole document	1-9

(continued)

* Special categories of cited documents : [10]

"A" Document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior t the international filing date but later than the priority date claimed

"T" Later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
13 August 1992 (13.08.92)	21 Aug 1992 (21.08.92)
International Searching Authority	**Signature of Authorized Officer**
AUSTRALIAN PATENT OFFICE	R. OSBORNE

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

X	Pesticide Biochemistry and Physiology, 32 (1988) pp. 247-252 KISS, T. "Properties of Na Channels of Identified Snail (Helix pomatia L.) Neurones Modified by Deltamethrin" - whole document	1-9
X	Acta hydrochim hydrobiol 19 (1991) 4,425-430 SINGH D.K. et al "Action sites of Cypermethrin, a Synthetic Pyrethroid in the Snail Lymnaea acuminata". - whole document	1-9

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers ..., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4a

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.